

# PATENT ABSTRACTS OF JAPAN

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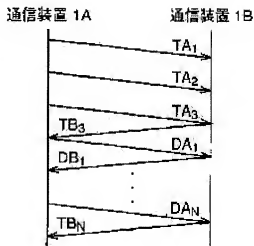
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## (54) TRANSMITTER, TRANSMISSION METHOD AND MEDIUM

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To transmit packets with a high throughput and high reliability.

**SOLUTION:** A communication unit 1A forms a packet TA1 whose packet length is longest, transmits it to a communication unit 1B. When no acknowledgment ACK is returned from the communication unit 1B, the communication unit 1A forms a packet TA2 whose packet length is decreases and transmits it to the communication unit 1B. When no ACK with respect to the packet TA2 is returned, the communication unit 1A forms a packet TA3 whose length is furthermore decreased and transmits it to the communication unit 1B. Upon the receipt of a packet TB3 that is an ACK packet from the communication unit 1B, the communication unit 1A forms a packet DA1 with the same packet length as that of the packet TA3 where user data to be sent first are arranged and transmits it to the communication unit 1B. Then the communication unit 1A sequentially arranges the user data to the packet whose length is the same as that of the packet TA3 and transmits the packet to the communication unit 1B.



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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the sending set with which sufficient throughput is obtained, a transmission method, and a medium, when transmitting a packet especially about a sending set, a transmission method, and a medium, for example.

[0002]

[Description of the Prior Art]As a transmission method of data, what arranges and transmits data to the packet of predetermined packet length is known, for example.

[0003]

[Problem(s) to be Solved by the Invention]By the way, when the transmission state of the transmission line which transmits a packet is bad and the packet length of the packet is long, a possibility that an error will arise during transmission of the packet becomes high. And when an error arises, the packet of the long packet length must be resent and, as a result, a throughput will deteriorate.

[0004]On the other hand, if packet length of a packet is shortened, as compared with the case where packet length is long, a possibility that an error will arise during transmission of a packet can be made low. However, when packet length is shortened, it is necessary to transmit many packets, although a constant rate of some data is transmitted. And since overheads, such as a header and a trailer, are added to a packet besides original information (data substantial so to speak to transmit truly), When the number of the packets which transmit increases, the rate of an overhead over the quantity of original information will also increase, and, as a result, a throughput will deteriorate too.

[0005]This invention is made in view of such a situation, and enables it to transmit a reliable packet by a bigger throughput.

[0006]

[Means for Solving the Problem] This invention is characterized by a sending set comprising the following.

A detection means to detect a transmission state of a packet through a transmission line.

An alteration means which changes the length of data arranged to a packet based on a transmission state.

[0007] The length of substantial data arranged to a packet can be made to change into an alteration means.

[0008] A sending set of this invention can be asked for an error correcting code about a packet, an error correcting code calculating means arranged to a packet can be further provided in it, and the length of an error correcting code can be made to change into an alteration means in this case.

[0009] A detection means can be made to detect a transmission state from a receiving set by making an acknowledge signal of a purport that normal reception of the packet was able to be carried out receive. A detection means can be made to detect a transmission state by making an error about a packet transmitted via a transmission line detect from a receiving set.

[0010] This invention is characterized by a transmission method comprising the following.

A detecting step which detects a transmission state of a packet through a transmission line.

A change step which changes the length of data arranged to a packet based on a transmission state.

[0011] This invention is characterized by a program which a computer is made to execute comprising the following in a medium.

A detecting step which detects a transmission state of a packet through a transmission line.

A change step which changes the length of data arranged to a packet based on a transmission state.

[0012] In a sending set of this invention, a transmission method, and a medium, a transmission state of a packet through a transmission line is detected, and the length of data arranged to a packet is changed based on the transmission state.

[0013]

[Embodiment of the Invention] Drawing 1 shows the example of composition of the 1 embodiment of the packet transmission equipment which applied this invention.

[0014] Mutually the communication apparatus 1A and 1B, for example ISDN (Integrated System Digital Network), A packet is transmitted and received via the transmission lines 3, such as the Internet, a CATV (Cable Television) network, and satellite connection.

[0015] The application 2A receives the user datum arranged at the packet received with the

communication apparatus 1A, and performs required processing while it supplies substantial data (suitably henceforth an user datum) to transmit to a predetermined partner to the communication apparatus 1A. Application 2B also processes by receiving the user datum arranged at the packet received with the communication apparatus 1B as well as the application 2A, while supplying an user datum to the communication apparatus 2A.

[0016]Drawing 2 shows the example of composition of the communication apparatus 1A and 1B of drawing 1.

[0017]The communication apparatus 1A comprises the receive section 11A, the packet decomposition part 12A, the error / acknowledge signal primary detecting element 13A, the packet generation part 14A, and the transmission section 15A, and the packet which has arranged the user datum from the application 2A is constituted, While transmitting to the communication apparatus 1B, the packet transmitted from the communication apparatus 1B is received, an user datum is extracted from there, and the application 2A is supplied.

[0018]That is, the receive section 11A receives the packet transmitted via the transmission line 3 from the communication apparatus 1B, and supplies the packet decomposition part 12A. From the packet from the receive section 11A, by deleting a header, a trailer, etc., the packet decomposition part 12A extracts only an user datum, and supplies it to the application 2A. An error / acknowledge signal primary detecting element (only henceforth a primary detecting element suitably) 13A, Are supervising the packet decomposition part 12A and the error of the packet supplied there is detected, By or the thing for which the acknowledgement (Acknowledgement) (suitably henceforth ACK) which is an acknowledge signal showing the check of the purport that normal reception of the packet from the communication apparatus 1B was carried out is detected. The transmission state (the existence of an error of the packet on the transmission line 3 and grade of an error) of the packet through the transmission line 3 is detected, and the packet generation part 14A is supplied. Setting up the length of the user datum arranged to a packet based on the transmission state supplied from the primary detecting element 13A, the packet generation part 14A constitutes the packet which has arranged the user datum supplied from the application 2A, and supplies it to the transmission section 15A. The transmission section 15A transmits the packet from the packet generation part 14A via the transmission line 3.

[0019]The receive section 11A, the packet decomposition part 12A from which the communication apparatus 1B also constitutes the communication apparatus 1A, An error / acknowledge signal primary detecting element 13A, the packet generation part 14A, or the transmission section 15A and the respectively same receive section 11B, Comprise the packet decomposition part 12B, the error / acknowledge signal primary detecting element 13B, the packet generation part 14B, or the transmission section 15B, and the packet which has arranged the user datum from application 2B is constituted, While transmitting to the

communication apparatus 1A, the packet transmitted from the communication apparatus 1A is received, an user datum is extracted from there, and application 2B is supplied.

[0020]Next, while using the communication apparatus 1A as the sending set which transmits a packet, the communication apparatus 1B is explained as a receiving set which receives the packet about transmitting processing of the packet by the communication apparatus 1A as a sending set, and the reception of the packet by the communication apparatus 1B as a receiving set. As mentioned above, it is also possible for the communication apparatus 1A and 1B to serve as an identical configuration, therefore for the communication apparatus 1A to function as a receiving set, and to operate the communication apparatus 1B as a sending set, respectively.

[0021]First, with reference to the flow chart of drawing 3, the transmitting processing by the communication apparatus 1A is explained.

[0022]When the user datum which should be transmitted from the application 2A is supplied to the communication apparatus 1A, in Step S1 the packet generation part 14A, The longest packet length is set up as packet length, it is a packet of such packet length, the packet which has arranged dummy data (dummy data) is constituted, and the transmission section 15A is supplied. In this case, in the transmission section 15A, the packet of the longest packet length of the packet generation part 14A is transmitted to the communication apparatus 1B via the transmission line 3.

[0023]Here, in this embodiment, transmission and reception of the packet of variable packet length are performed, and the variable maximum and minimum of packet length are set up beforehand. And the packet of the packet length of the maximum is constituted and transmitted in Step S1.

[0024]After a packet is transmitted at Step S1, in Step S2, the primary detecting element 13A detects the transmission state of the packet through the transmission line 3, and judges whether it is good or poor.

[0025]That is, when the communication apparatus 1B carries out normal reception of the packet transmitted from the communication apparatus 1A, ACK is returned to the communication apparatus 1A via the transmission line 3, and the ACK is supplied to the packet decomposition part 12A via the receive section 11A. The packet decomposition part 12A is supervised, ACK detects whether the packet decomposition part 12A was supplied from the receive section 11A, and the primary detecting element 13A judges a transmission state based on the detection result. Or the primary detecting element 13A detects whether the user datum extracted by the packet decomposition part 12A has an error (error) from the newest packet of the communication apparatus 1B received in the receive section 11A, and judges a transmission state based on the detection result.

[0026]When it judges that a transmission state is poor in Step S2. [ whether ACK was

transmitted from the communication apparatus 1B, and ] Or when an error is detected from the newest packet transmitted from the communication apparatus 1B, a signal (suitably henceforth a poor signal) to that effect is supplied to the packet generation part 14A from the primary detecting element 13A, and progresses to Step S5.

[0027]If the packet generation part 14A receives a poor signal from the primary detecting element 13A, in Step S5, the packet length set up now will judge whether it is equal to the shortest packet length (minimum of variable packet length mentioned above). In Step S5, when it judges that the packet length set up now is not the shortest packet length, it progresses to Step S6, and the packet generation part 14A newly sets up the packet length only whose predetermined length is shorter than the packet length set up now, and follows it to Step S7.

[0028]The packet generation part 14A constitutes the packet of the newly set-up packet length by which dummy data has been arranged, and the transmission section 15A is made to supply and transmit it in Step S7. And it returns to Step S2 and the same processing is repeated hereafter. Therefore, in Step S2, shortening packet length one by one and transmitting the packet by which dummy data has been arranged is repeated until it judges that a transmission state is good (i.e., until it can carry out normal reception of the packet in the communication apparatus 1B).

[0029]When it judges that the packet length set up now is the shortest packet length in Step S5, That is, when more than it and packet length cannot be shortened, it progresses to Step S8, and the packet generation part 14A performs error handling of, transmitting the message of the purport that a packet cannot be transmitted to the application 2A for example, and ends transmitting processing.

[0030]On the other hand, when it judges that a transmission state is good in Step S2. [ whether ACK has been transmitted from the communication apparatus 1B, and ] Or when an error is not detected from the newest packet transmitted from the communication apparatus 1B, a signal (suitably henceforth a good signal) to that effect is supplied to the packet generation part 14A from the primary detecting element 13A, and progresses to Step S3.

[0031]In Step S3, the packet generation part 14A, Only specified length is started and arranging a header or a trailer at the head or the last of an user datum of the specified length, respectively constitutes the packet of the packet length set up now from the head of the user datum from the application 2A. The packet generation part 14A supplies the packet to the transmission section 15A, and makes it transmit.

[0032]And it progresses to step S4 and a transmission state is judged in the primary detecting element 13A like the case in Step S2. In step S4, when it judges that a transmission state is poor, it progresses to Step S5 and same processing is performed hereafter. Therefore, when a transmission state gets worse and it becomes impossible to carry out normal reception of the

packet in the communication apparatus 1B during transmission of the packet by which the user datum has been arranged. Packet length is shortened (Step S2, S5 to S7), and transmission of a packet is continued after that until the communication apparatus 1B can carry out normal reception of the packet now again (Step S3).

[0033]In the communication apparatus 1B when it judges that a transmission state is good in step S4, When normal reception of the packet of the present packet length can be being carried out, it progresses to step S9 and it is judged whether transmission to all the communication apparatus 1B of the user data from the application 2A was completed. In step S9, when it judges that transmission of all the user data from the application 2A has not completed yet, it returns to Step S3 and the same processing is repeated hereafter.

[0034]On the other hand, in step S9, when judged with all the transmission of the user datum from the application 2A having been completed, transmitting processing is ended.

[0035]Next, with reference to the flow chart of drawing 4, the reception by the communication apparatus 1B is explained.

[0036]If a packet is transmitted via the transmission line 3 from the communication apparatus 1A as it mentioned above, in Step S11, the receive section 11B will receive the packet, and will supply the packet decomposition part 12B. The packet decomposition part 12B decomposes the packet from the receive section 11B, namely, deletes a header, a trailer, etc. from a packet, and extracts an user datum (or dummy data). Although packet length or payload length is needed for extraction of the user datum from a packet, this is arranged in a header or a trailer, for example in the packet generation part 14A.

[0037]Then, it progresses to Step S12 and it is judged in the primary detecting element 13B whether the user datum was able to be received normally. That is, the primary detecting element 13B is supervising the packet decomposition part 12B, detects whether the user datum extracted by the packet decomposition part 12B has an error, and judges whether the user datum was able to be received normally based on the detection result.

[0038]Although it is [ for it (for example, error detection codes such as CRC (Cyclic Redundancy Check)) ] needed for error detection, this is arranged, for example in the packet generation part 14A or 14B at a trailer at the time of transmission of a packet.

[0039]In Step S12, when judged with the ability of the user datum to have been received normally, the primary detecting element 13B outputs a good signal to the packet generation part 14B, and progresses to Step S13. If a good signal is received from the primary detecting element 13B, in Step S13, by controlling the communications department 15B, the packet generation part 14B will make ACK transmit to the communication apparatus 1A via the transmission line 3, and will end reception.

[0040]In Step S12, when judged with the ability of an user datum to have not been received normally, Step S13 is skipped and reception is ended. Therefore, ACK is not transmitted to the



communication apparatus 1A in this case.

[0041]According to above transmitting processings and receptions, between the communication apparatus 1A as a sending set, and the communication apparatus 1B as a receiving set, an exchange as shown in drawing 5 is performed, for example.

[0042]That is, first, the communication apparatus 1A is arranging dummy data to a pay load, constitutes packet  $TA_1$  of the longest packet length, for example, and transmits to the communication apparatus 1B (Step S1). The packet length of packet  $TA_1$  has a high possibility that an error will arise in the middle of transmission through the transmission line 3 as it is shown in drawing 6 (A), since it is the longest, and if an error arises, the communication apparatus 1B cannot carry out normal reception of the packet  $TA_1$ . Therefore, although the

communication apparatus 1B does not return ACK, in this case, the communication apparatus 1A is that only specified length shortens payload length, and constitutes packet  $TA_2$  which shortened packet length, and it transmits it to the communication apparatus 1B (Step S6, S7).

[0043]And in the communication apparatus 1B, when normal reception of this packet  $TA_2$  is not able to be carried out. the communication apparatus 1A -- pay -- a funnel -- it is that only specified length shortens merit further, packet  $TA_3$  which shortened packet length more is constituted, and it transmits to the communication apparatus 1B (Step S6, S7).

[0044]Thus, if a possibility that an error will produce packet  $TA_3$  as packet length shortened, for example, shown in drawing 6 (B) in the middle of transmission through the transmission line 3 becomes low and an error does not arise, the communication apparatus 1B carries out normal reception of the packet  $TA_3$ . If the communication apparatus 1B carries out normal reception of the packet  $TA_3$ , it will transmit packet  $TB_3$  as ACK to the communication apparatus 1A.

[0045]The communication apparatus 1A by arranging the user datum which should be first transmitted to a pay load from the communication apparatus 1B, if packet  $TB_3$  as ACK is received, Packet  $DA_1$  of the same packet length as packet  $TA_3$  is constituted, and it transmits to the communication apparatus 1B (Step S3).

[0046]And if the communication apparatus 1B carries out normal reception of the packet  $DA_1$ , it will transmit packet  $DB_1$  as ACK to the communication apparatus 1A. Transmission of the packet from the communication apparatus 1A to 1B and transmission of ACK from the communication apparatus 1B to 1A are repeated by turns in a similar manner hereafter, if packet  $DA_N$  by which the last user datum has been arranged is transmitted to 1B from the communication apparatus 1A and packet  $DB_N$  as ACK to it is transmitted to 1A from the

communication apparatus 1B, communication between the communication apparatus 1A and 1B will be completed.

[0047]After transmission of the packet of the packet length same as mentioned above here as packet TA<sub>3</sub> which had the user datum arranged is started, it originates in aggravation of the state of the transmission line 3, etc., for example, It becomes impossible to carry out normal reception of the packet in the communication apparatus 1B, and ACK may stop coming on the contrary from the communication apparatus 1B. in this case -- until, as for the communication apparatus 1A, the communication apparatus 1B can carry out normal reception of the packet now -- pay -- a funnel -- short [ of the merit ] is carried out (Step S6), and this constitutes the packet which shortened packet length more, and it transmits (Step S7).

[0048]Although the communication apparatus 1B transmits the packet as ACK to the communication apparatus 1A, packet length of the packet transmitted to 1A from this communication apparatus 1B is made into the same packet length as the packet transmitted from the communication apparatus 1A. Although it is necessary in the communication apparatus 1B to recognize the packet length of the packet from the communication apparatus 1A in this case, this packet length can be recognized by referring to the header or trailer of a packet from the communication apparatus 1A.

[0049]As mentioned above, in the communication apparatus 1B, until it can carry out normal reception of the packet, Since packet length was shortened one by one, the packet was transmitted, and the communication apparatus 1B specifies the packet length which can carry out normal reception of the packet and transmitted the packet of the packet length by this, A packet can be transmitted so that it may be a bigger throughput and an error may not arise.

[0050]By the way, in [ after transmission of the packet of the same packet length as packet TA<sub>3</sub> which had the user datum arranged is started in drawing 5 for example, the state of the transmission line 3 is improved, for example and ] the communication apparatus 1A as a result, Even if it transmits the packet of longer packet length, in the communication apparatus 1B, it may be able to come to carry out normal reception of the packet. In this case, a throughput can be raised more by lengthening packet length.

[0051]Then, with reference to the flow chart of drawing 7, the transmitting processing which raises a throughput more is explained in this way.

[0052]In this case, in Step S31, S32, S36 to S39, the respectively same processing as the case in Step S1 of drawing 3, S2, S5 to S8 is performed.

[0053]And. [ whether when it judges that a transmission state is good in Step S32, ACK has been transmitted from the communication apparatus 1B, and ] Or when an error is not detected from the newest packet transmitted from the communication apparatus 1B, therefore normal reception of the packet is able to be carried out with the communication apparatus 1B, a good signal is supplied to the packet generation part 14A from the primary detecting element

13A, and progresses to Step S33.

[0054]In Step S33, the packet generation part 14A initializes the variable i for counting the transmission frequency of a packet to 0, it progresses to Step S34, and the respectively same processing as the case in Step S3 of drawing 3, S4, and S9 is hereafter performed in Step S34, S35, and S40.

[0055]And in Step S40, when it judges that all the transmission of the user datum from the application 2A has not completed yet, it progresses to Step S41, and only 1 \*\*\*\*\*s the variable i and the packet generation part 14A follows it to Step S42. In Step S42, it is judged in the packet generation part 14A whether the variable i is equal to the predetermined number of times M.

[0056]In Step S42, when it judges that the variable i is not equal to the predetermined number of times M, it returns to Step S34. Therefore, transmission of the packet in the same packet length as the packet transmitted last time in this case is repeated.

[0057]In the communication apparatus 1B when it judges that the variable i is equal to the predetermined number of times M in Step S42 on the other hand, When only the predetermined number of times M is able to perform normal reception of the packet of predetermined packet length continuously, it progresses to Step S43, and the packet generation part 14A newly sets up the packet length only whose predetermined length is longer than the packet length set up now, and follows it to Step S44.

[0058]In Step S44, constitute the packet of the newly set-up packet length by which dummy data has been arranged, and supply the transmission section 15A, it is made to transmit, and the packet generation part 14A returns to Step S32.

[0059]Therefore, if it judges that a transmission state is good in Step S32 in this case (i.e., if normal reception of the packet to which only predetermined length lengthened packet length can be carried out in the communication apparatus 1B), transmission of the packet in that lengthened packet length will be performed after that.

[0060]According to the above transmitting processings, between the communication apparatus 1A as a sending set, and the communication apparatus 1B as a receiving set, an exchange as shown in drawing 8 is performed, for example.

[0061]That is, first, the communication apparatus 1A is arranging dummy data to a pay load, constitutes packet TA<sub>1</sub> of the longest packet length, for example, and transmits to the communication apparatus 1B (Step S31). The packet length of packet TA<sub>1</sub> has a high possibility that an error will arise in the middle of transmission through the transmission line 3 as it was shown in drawing 6 (A), since it was the longest, and if an error arises, the communication apparatus 1B cannot carry out normal reception of the packet TA<sub>1</sub>. Therefore, although the communication apparatus 1B does not return ACK, in this case, the

communication apparatus 1A is that only specified length shortens payload length, and constitutes packet  $TA_2$  which shortened packet length, and it transmits it to the communication apparatus 1B (Step S37, S38).

[0062]And in the communication apparatus 1B, when normal reception of this packet  $TA_2$  is not able to be carried out. the communication apparatus 1A -- pay -- a funnel -- it is that only specified length shortens merit further, packet  $TA_3$  which shortened packet length more is constituted, and it transmits to the communication apparatus 1B (Step S37, S38).

[0063]Thus, if a possibility that an error will produce packet  $TA_3$  as packet length shortened, for example, shown in drawing 6 (B) in the middle of transmission through the transmission line 3 becomes low and an error does not arise, the communication apparatus 1B carries out normal reception of the packet  $TA_3$ . If the communication apparatus 1B carries out normal reception of the packet  $TA_3$ , it will transmit packet  $TB_3$  as ACK to the communication apparatus 1A.

[0064]The communication apparatus 1A by arranging the user datum which should be first transmitted to a pay load from the communication apparatus 1B, if packet  $TB_3$  as ACK is received, Packet  $DA_1$  of the same packet length as packet  $TA_3$  is constituted, and it transmits to the communication apparatus 1B (Step S34).

[0065]And if the communication apparatus 1B carries out normal reception of the packet  $DA_1$ , it will transmit packet  $DB_1$  as ACK to the communication apparatus 1A. Hereafter, similarly, they are repeated by turns by transmission of the packet from the communication apparatus 1A to 1B, and transmission of ACK from the communication apparatus 1B to 1A, and by this, When transmission of a packet is continuously successful M times, namely, the same packet  $DA_M$  of packet length as packet  $TA_3$ . When the communication apparatus 1A receives, packet  $DB_M$  as ACK which normal reception is carried out in the communication apparatus 1B, and expresses that the communication apparatus 1A, Packet  $TA_4$  which lengthened packet length and has arranged dummy data to the pay load because only specified length lengthens payload length is constituted, and it transmits to the communication apparatus 1B (Step S43, S44).

[0066]The communication apparatus 1B transmits packet  $TB_4$  as ACK to the communication apparatus 1A, when normal reception of the packet  $TA_4$  whose packet length is longer than packet  $DA_M$  which received last time is able to be carried out.

[0067]From the communication apparatus 1B, if packet  $TB_4$  as ACK is received, the

communication apparatus 1A by arranging the user datum of a continuation to a pay load, Packet  $DA_{M+1}$  of packet length longer than the same packet  $DA_{M+1}$  of packet length as packet  $TA_4$ , i.e., the packet which had transmitted until now, is constituted, and it transmits to the communication apparatus 1B (Step S34).

[0068]And if the communication apparatus 1B carries out normal reception of the packet  $DA_{M+1}$ , it will transmit signal  $DB_{M+1}$  as ACK to the communication apparatus 1A. If same processing is performed, packet  $DA_N$  by which the last user datum has been arranged is hereafter transmitted to 1B from the communication apparatus 1A and ACK to it is transmitted to 1A from the communication apparatus 1B, communication between the communication apparatus 1A and 1B will be completed.

[0069]As mentioned above, in the embodiment of drawing 7, in the communication apparatus 1B, when only the predetermined number of times M is able to perform normal reception of the packet of predetermined packet length continuously. In the communication apparatus 1A, since the packet which lengthened packet length is constituted and transmitted, even if the state of the transmission line 3 is improved and it transmits the packet of longer packet length, for example, when the normal reception becomes possible, a throughput can be raised more. As for M, since transmission of dummy data will be performed frequently and a throughput will fall as a result if a small value is set up although M can be made into one or more integral values, it is desirable to consider it as a to some extent big value.

[0070]Next, drawing 9 shows other examples of composition of the communication apparatus 1A and 1B of drawing 1. About the case in drawing 2, and the corresponding portion, the same numerals are attached among the figure, and, below, the explanation is omitted suitably. Namely, while the error correction part 21A is newly formed between the receive section 11A and the packet decomposition part 12A, the communication apparatus 1A, Between the packet generation part 14A and the transmission section 15A, the error correction code adjunct 22A is newly formed, and also. Are constituted fundamentally like the case in drawing 2, and while the error correction part 21B is newly formed between the receive section 11B and the packet decomposition part 12B, the communication apparatus 1B, It is constituted fundamentally like the case [ between the packet generation part 14B and the transmission section 15B, the error correction code adjunct 22B is newly formed, and also ] in drawing 2.

[0071]In the communication apparatus 1A and 1B of drawing 9, at the time of transmission of a packet, the error correction code for an error correction is added and transmitted to a packet, and the error correction of a packet is performed using the error correction code at the time of reception of a packet.

[0072]That is, to the packet which the receive section 11A received, the error correction part 21A performs error correction (error correction) processing by an error correction code, and

supplies the processing result to the packet decomposition part 12A.

[0073]About the packet generation part 14A to a packet, for example the error correction code adjunct 22A calculates the error correction code for error corrections, such as a Hamming code, a BCH code, Fire numerals, and the Lwaware numerals, arranges it to a packet, and is supplied to the transmission section 15A. In this embodiment, an error correction code is arranged with an user datum at a pay load, for example.

[0074]The error correction part 21B or the error correction code adjunct 22B as well as [ respectively ] the error correction part 21A or the error correction code adjunct 22A is constituted.

[0075]Next, like an above-mentioned case, while using the communication apparatus 1A as a sending set, transmitting processing of the packet by the communication apparatus 1A and the reception of the packet by the communication apparatus 1B are explained by using the communication apparatus 1B as a receiving set.

[0076]First, with reference to the flow chart of drawing 10, the transmitting processing by the communication apparatus 1A of drawing 9 is explained.

[0077]When the user datum which should be transmitted from the application 2A is supplied to the communication apparatus 1A, in Step S51 the packet generation part 14A, The longest packet length is set up as packet length, it is a packet of such packet length, the packet which has arranged dummy data is constituted, and the error correction code adjunct 22A is supplied. About the packet from the packet generation part 14A, the error correction code adjunct 22A calculates an error correction code, adds the error correction code to a packet (arrangement), and supplies it to the transmission section 15A. In the transmission section 15A, the packet from the error correction code adjunct 22A is transmitted to the communication apparatus 1B via the transmission line 3.

[0078]Here in the error correction code adjunct 22A (also setting to the error correction code adjunct 22B the same). Based on the signal from an error / acknowledge signal primary detecting element 13A, variable code length's error correction code can be calculated now, and the code length's maximum and minimum are set up beforehand. And in Step S51, as code length of an error correction code, the code length of a minimum is set up and the error correction code of the code length of the minimum is calculated.

[0079]As an error correction code, when using a Hamming code, according to the Hamming code of  $n$  bit, the 1-bit arbitrary errors of the  $2^n - 1$  bit data rows can be corrected, for example. Therefore, generally, the error correction ability will become high so that the code length of an error correction code is long, but. If this is said conversely, in order to make error correction ability high, it is necessary to add code length's long error correction code, redundant data will increase in this case, and a throughput will fall.

[0080]After a packet is transmitted at Step S51, in Step S52, in the primary detecting element

13A, the transmission state of the packet through the transmission line 3 is detected, and it is judged whether it is good or poor.

[0081] That is, the primary detecting element 13A judges a transmission state based on the existence of ACK from the communications department 1B, as mentioned above. Or although the packet from the communication apparatus 1B is received, an error correction is performed and the packet decomposition part 12A is supplied in the error correction part 21A in the receive section 11A in the communication apparatus 1A by the error correction code added to the packet. In the primary detecting element 13A, it detects whether the user datum arranged from the communication apparatus 1B to the newest packet after an error correction that makes it such and is supplied to the packet decomposition part 12A has an error (error), and a transmission state is judged based on the detection result.

[0082] When it judges that a transmission state is poor in Step S52. [ whether ACK was transmitted from the communication apparatus 1B, and ] Or when an error is detected from the newest packet transmitted from the communication apparatus 1B, a signal (poor signal) to that effect is supplied to the error correction code adjunct 22A from the primary detecting element 13A, and progresses to Step S55.

[0083] If the error correction code adjunct 22A receives a poor signal from the primary detecting element 13A, in Step S55, the code length set up now will judge whether it is equal to the longest code length (variable code length's maximum mentioned above). In Step S55, when it judges that the code length set up now is not the longest code length, it progresses to Step S56, and the error correction code adjunct 22A newly sets up the code length only whose predetermined length is longer than the code length set up now, and follows him to Step S57.

[0084] In Step S57, dummy data constitutes the arranged packet and supplies the packet generation part 14A to the error correction code adjunct 22A. The error correction code adjunct 22A calculates and adds code length's error correction code set up now about the packet from the packet generation part 14A, and supplies it to the transmission section 15A. In the transmission section 15A, it is transmitted via the transmission medium 3, the packet from the error correction code adjunct 22A returns to Step S52, and the same processing is repeated hereafter. Therefore, in Step S52, lengthening code length of an error correction code one by one, and transmitting the packet by which dummy data has been arranged is repeated until it judges that a transmission state is good (i.e., until it can carry out normal reception of the packet in the communication apparatus 1B).

[0085] When it judges that the code length set up now is the longest code length in Step S55, That is, when code length of more than it and an error correction code cannot be lengthened, it progresses to Step S58, and the packet generation part 14A performs the same error handling as the case in Step S8 of drawing 3, and ends transmitting processing.

[0086] On the other hand, when it judges that a transmission state is good in Step S52.

[ whether ACK has been transmitted from the communication apparatus 1B, and ] Or when an error is not detected from the newest packet transmitted from the communication apparatus 1B (even if there is an error) The signal (good signal) to that effect which includes the case where it can correct, with an error correction code is supplied to the error correction code adjunct 22A from the primary detecting element 13A, and progresses to Step S53.

[0087]In Step S53, the packet generation part 14A, From the head of the user datum from the application 2A, only specified length is started, by arranging a header or a trailer, respectively, a packet is constituted at the head or the last of an user datum of the specified length, and it is supplied at the error correction code adjunct 22A. The error correction code adjunct 22A about the user datum arranged from the packet generation part 14A to a packet. Code length's error correction code set up now is calculated, and the error correction code is arranged between the user datum and trailer of a packet, and is supplied to the transmission section 15A. And in the transmission section 15A, the packet from the error correction code adjunct 22A is transmitted via the transmission line 3.



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damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

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## CLAIMS

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[Claim(s)]

[Claim 1]A sending set which packet-izes data and transmits to a receiving set via a predetermined transmission line, comprising:

A detection means to detect a transmission state of said packet through said transmission line.

An alteration means which changes the length of data arranged to said packet based on said transmission state.

A transmitting means which transmits said packet via said transmission line.

[Claim 2]The sending set according to claim 1, wherein said alteration means changes the length of substantial data arranged to said packet.

[Claim 3]The sending set according to claim 1 characterized by said alteration means changing the length of said error correcting code including further an error correcting code calculating means which asks for an error correcting code about said packet, and is arranged to said packet.

[Claim 4]The sending set according to claim 1, wherein said detection means is receiving an acknowledge signal of a purport normal reception of said packet having been carried out and detects said transmission state from said receiving set.

[Claim 5]The sending set according to claim 1 which said detection means is detecting an error about a packet transmitted via said transmission line from said receiving set, and is characterized by detecting said transmission state.

[Claim 6]A transmission method which packet-izes data and transmits to a receiving set via a predetermined transmission line, comprising:

A detecting step which detects a transmission state of said packet through said transmission line.

A change step which changes the length of data arranged to said packet based on said

transmission state.

A transmission step which transmits said packet via said transmission line.

[Claim 7] A medium which makes a computer execute a program for packet-izing data and performing transmitting processing which transmits to a receiving set via a predetermined transmission line, comprising:

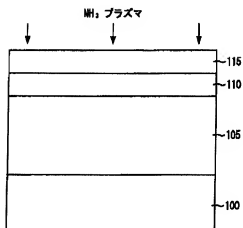
A detecting step which detects a transmission state of said packet through said transmission line.

A change step which changes the length of data arranged to said packet based on said transmission state.

A transmission step which transmits said packet via said transmission line.

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[Translation done.]

Drawing selection Representative drawing 

[Translation done.]

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]It is a block diagram showing the example of composition of the 1 embodiment of the packet transmission equipment which applied this invention.

[Drawing 2]It is a block diagram showing the example of composition of the communication apparatus 1A and 1B of drawing 1.

[Drawing 3]It is a flow chart for explaining the transmitting processing by the communication apparatus 1A of drawing 2.

[Drawing 4]It is a flow chart for explaining the reception by the communication apparatus 1B of drawing 2.

[Drawing 5]It is a figure for explaining the exchange between the communication apparatus 1A and 1B of drawing 2.

[Drawing 6]It is a figure showing the packet exchanged among the communication apparatus 1A and 1B of drawing 2.

[Drawing 7]It is a flow chart for explaining other transmitting processings by the communication apparatus 1A of drawing 2.

[Drawing 8]It is a figure for explaining the exchange between the communication apparatus 1A and 1B of drawing 2.

[Drawing 9]It is a block diagram showing other examples of composition of the communication apparatus 1A and 1B of drawing 1.

[Drawing 10]It is a flow chart for explaining the transmitting processing by the communication apparatus 1A of drawing 9.

[Drawing 11]It is a flow chart for explaining the reception by the communication apparatus 1B of drawing 9.

[Drawing 12]It is a flow chart for explaining other transmitting processings by the communication apparatus 1A of drawing 9.

[Drawing 13] It is a figure showing the packet exchanged among the communication apparatus 1A and 1B of drawing 9.

[Drawing 14] It is a figure showing the packet exchanged among the communication apparatus 1A and 1B of drawing 9.

[Drawing 15] It is a figure for explaining the medium which applied this invention.

[Drawing 16] It is a block diagram showing the example of composition of the computer 101 of drawing 15.

[Description of Notations]

1A and 1B A communication apparatus, 2A, and 2B Application, Three transmission lines, and 11A and 11B A receive section, and 12A and 12B. A packet decomposition part, 13A, and 13B An error / acknowledge signal primary detecting element, 14A, 14B packet generation part, and 15A and 15B A transmission section, 21A, 21B error correction part, 22A, 22B error correction code adjunct, and 101 A computer, 102 A hard disk and 103 semiconductor memory, 111 A floppy disk and 112 CD-ROM, 113 MO disks and 114 DVD, 115 A magnetic disk and 116 semiconductor memory, 121 A download site and 122 [ An indicator, 147 input parts, and 148 / The communications department and 149 / Drive ] A satellite and 131 A network and 141 A bus, 142 CPU, 143 ROM, 144 RAM, 145 input/output interfaces, and 146

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[Translation done.]

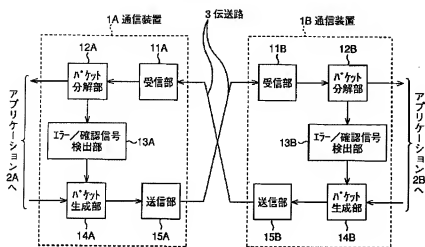
## Drawing selection Drawing 1



パケット伝送装置

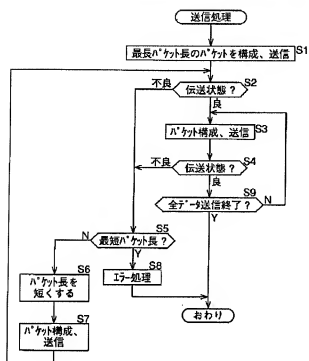
[Translation done.]

## Drawing selection Drawing 2



[Translation done.]

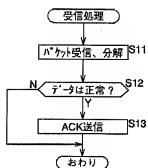
## Drawing selection Drawing 3



[Translation done.]

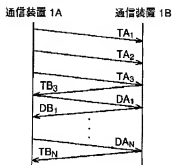


## Drawing selection Drawing 4



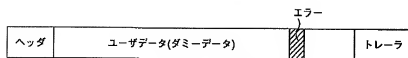
[Translation done.]

## Drawing selection Drawing 5

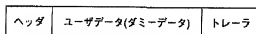


[Translation done.]

## Drawing selection Drawing 6



(A) 長いパケットの例(エラーあり)

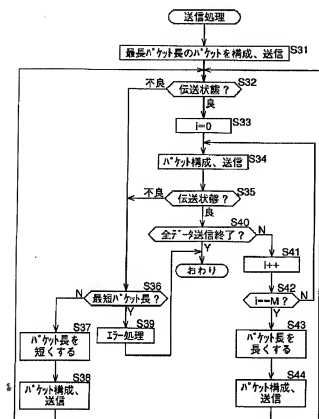


(B) 短いパケットの例

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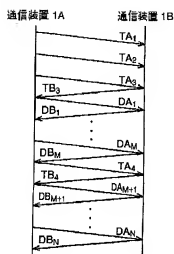
[Translation done.]

## Drawing selection Drawing 7



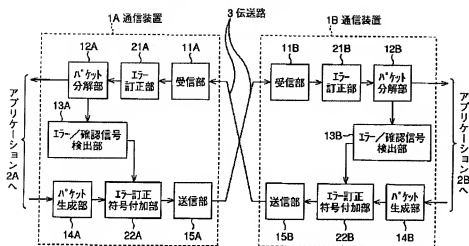
[Translation done.]

## Drawing selection Drawing 8



[Translation done.]

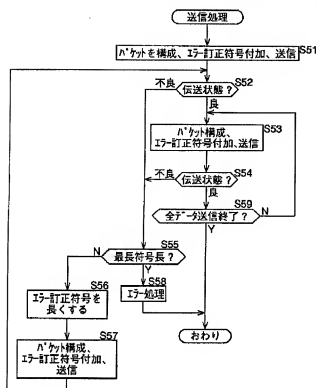
## Drawing selection Drawing 9



[Translation done.]

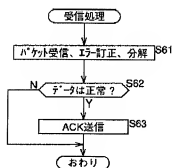
通信

## Drawing selection Drawing 10



[Translation done.]

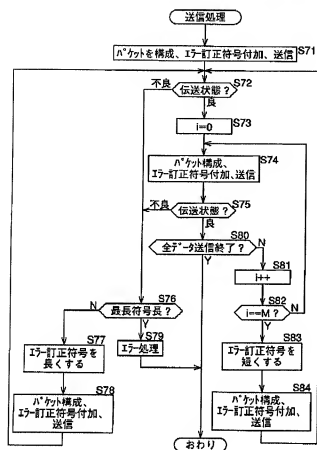
## Drawing selection Drawing 11



[Translation done.]



## Drawing selection Drawing 12



[Translation done.]

Drawing selection Drawing 13

ヘッダ	ユーザデータ(ダミーデータ)	短訂正符号	トレーラ
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短いエラー訂正符号



ヘッダ	ユーザデータ(ダミーデータ)	長訂正符号	トレーラ
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長いエラー訂正符号

[Translation done.]

## Drawing selection Drawing 14

ヘッダ	ユーザデータ(ダミーデータ)	エラー訂正符号	トレーラ
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短いエラー訂正符号



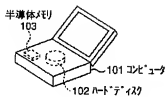
ヘッダ	ユーザデータ(ダミーデータ)	エラー訂正符号	トレーラ
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長いエラー訂正符号

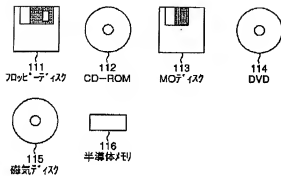
[Translation done.]

## Drawing selection Drawing 15

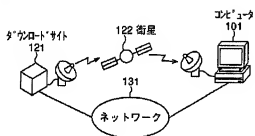
(A)



(B)

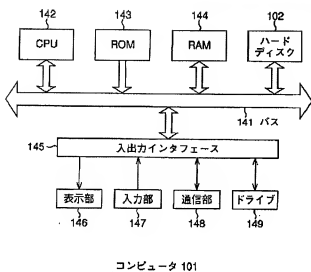


(C)



[Translation done.]

## Drawing selection Drawing 16



[Translation done.]